

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

**VIDEO WORKING GROUP**  
**STANDARDS ARCHITECTURE**  
**VERSION 0.96**  
**16 January 1997**

**Initial Draft Prepared by**  
**Stephen W. Long**  
**Video Working Group Sr. Scientist**

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

## **1.0 INTRODUCTION**

### **1.1 Mission**

Whereas, video imagery has been recognized by the Department of Defense / Intelligence Community (DoD/IC) as a fundamentally important source of imagery intelligence, and

Whereas, real-time battlefield awareness, using video sensors such as Unmanned Aerial Vehicles (UAVs) has been a key technological advancement driving DoD/IC interest in video systems; the

**Video Working Group** was established in July 1995, under the umbrella of the Imagery Standards Management Committee (ISMC) to formulate baseline standards for video within the U.S. Government, consistent with the United States Imagery Geospatial and Information System (USIGS) 2000 architecture.

This document is a direct expression of the Video Working Group (VWG) mission, and summarizes VWG work to date and therein becomes the Standards Architecture, Version 1.0, as presented to the Video Working Group for adoption on 16 January 1997.

This Architecture is comprised of COMMERCIAL STANDARDS, INTEROPERABILITY PROFILES AND RECOMMENDED PRACTICES FOR DOD/IC IMPLEMENTATIONS, and IMAGE QUALITY ASSURANCE RECOMMENDED PRACTICES. The differences of each type of specification are given in their respective document chapters.

# **VIDEO WORKING GROUP STANDARDS ARCHITECTURE**

## **VERSION 0.96 16 January 1997**

### **1.2 General Applicability**

The technology of the commercial video industry, portions of which DoD/IC users procure and use to meet government missions, is in a significant transition phase from analog to digital implementations. Over many years organizations such as the Society of Motion Picture and Television Engineers (SMPTE) have worked to standardize video systems to facilitate interoperability for the highest quality production and broadcast environments. Such standardization has supported the entire industry by giving broadcasters and production centers confidence that systems from multiple vendors would work interchangeably while also preserving the highest possible quality. The analog to digital migration has followed similar patterns, where standards have been in place for several years to facilitate interoperability of the highest quality digital production systems.

Standards and interoperability for low end (consumer grade) video systems (including Internet based video) are not as well defined, and for the special case of very low data rate dissemination of (at best) mediocre quality video, there are few if any standards. For such low bandwidth cases, universal interoperability is rightly a significant concern for DoD/IC managers.

Therefore, this Standards Architecture reflects the video industry technology upon which it is based. Over the past year the VWG has been able to identify commercial standards to define interoperability for high quality production environments, including high bandwidth transmission of compressed video signals. This Standards Architecture has identified approaches for interoperability between the very high quality systems and low bandwidth systems but it does not, as of the production of this Version 1.0, completely define an architecture for very low bandwidth systems. It is anticipated that the VWG and the video industry as a whole will continue to research and refine the technologies required to improve very low bandwidth video systems.

Users of this Standards Architecture can look to this document for guidance on implementing very high quality production center based systems, such as common control vans, interconnections nodes, and DoD/IC command centers. All of the technology outlined in this document is commercially available (or will be so in less than six months). At its most basic technical level, users can consider the majority of this document as defining digital video for systems using data rates greater than 1.5 Mb/s (T1 and greater). For sub-T1 data rates, such as video teleconference systems, further standards research and coordination is required and will continue. Therefore, by reference here, video teleconference systems are specifically excluded from this architecture.

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

**1.3 VWG Adoption Categories**

*Note: Section 1.3 will be replaced in its entirety in document Version 1.0.*

*Categories of anticipated Video Working Group adoption include:*

- 1) Adoption (vote on 16 Jan 97).*
- 2) Recommendation for 30 Day Automatic Adoption (suspense date of 15 Feb. 97), where the item is considered adopted unless substantive objections (new standard, interoperability issues, etc.) are posted via E-mail to the VWG e-mail reflector. The VWG Chair will form an Executive Committee composed of the VWG Chair, Sub-Group Chairs and Sr. Technical Advisors to evaluate any such comments. If the comments and issues can be resolved by consensus with the Executive Committee and the issue respondent, the item will be considered adopted. If the Executive Committee can not resolve the issues, then it will suspend adoption action until the April 1997 VWG meeting.*
- 3) Recommendation for Preliminary Concept Acceptance of STUDIES - where the primary initial parameters are outlined and understood but additional coordination or engineering analysis is required. Such items will be forwarded to the appropriate VWG sub-group or ad-hoc committees for action item work-off, with an anticipated completion date NLT the April 1997 VWG meeting or as otherwise noted.*

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

**1.4 Implementation Concepts**

*This new section will outline the engineering concepts and assumptions underlying the Standards, Profiles and Recommended Practices of this document. This new material will be included to provide context for the detailed provisions of the Standards Architecture. This new material will be based primarily on existing VWG briefing documents: “General Introduction and Digital Video Architecture Concepts for DoD and Intelligence Applications” (3 Dec 1996); “Advanced Technology & Metadata Architecture Concepts for DoD and Intelligence Applications” (15 Jan 1997); and Section 5.0 of this Standards Architecture.*

Figures in this section illustrate typical implementations of the standards and practices of this architecture. However, no references from these figures shall be used in lieu of the detailed descriptions of Sections 2, 3 and 4 of this document.

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

## **2.0 COMMERCIAL STANDARDS**

Where the term STANDARD is used, this document assumes a binding technical implementation policy, based primarily on an identified commercial (or ITU) standard, and by formal adoption by the Video Working Group (VWG), as ratified by the Imagery Standards Management Committee (ISMC), becomes applicable to all Department of Defense/Intelligence Community (DoD/IC) video systems.

For point of clarification, in commercial practice the majority of identified standards (notably those from SMPTE) are considered to be “voluntary” standards, where equipment manufacturers and users are free to choose to comply or to not comply with the standard. Standards, as represented in this Architecture, chosen by specific VWG adoption (as ratified by the ISMC) are not considered voluntary for DoD/IC users and systems but form a binding technical implementation policy, and as such, may be identified in Government procurement actions as a mandatory requirement in order for vendor offerings to be considered compliant for acceptance by the Government.

Table 2.1 summarizes the Commercial Standards, Interoperability Profiles and Recommended Practices for DoD/IC Implementations, and Image Quality Assurance Recommended Practices forming the basis of this Architecture document. However, Table 2.1 shall not be used in lieu of the detailed descriptions of this document.

# VIDEO WORKING GROUP STANDARDS ARCHITECTURE

## VERSION 0.96 16 January 1997

Table 2.1 Summary Video Standards

Item	Formal Standard ID	Common Name	VWG Specification Extensions
9601 - Digital Video, Compression Systems		MPEG-2	
9701 - Digital Video, Compression Systems	ISO/IEC 13818-1,2,3,4	MPEG-2 4:2:2 P Profile @ ML	See detailed notes for specific extensions.
	ISO/IEC 13818-1,2,3,4	MPEG-2 4:2:0 MP @ ML	See detailed notes for specific extensions.
9702 - Digital Video Waveform	ITU-R BT.601-4	4:2:2 Component Digital Video	See detailed notes for specific extensions.
9703 - Digital Video, Uncompressed Baseband Signal Transport and Processing	SMPTE 259M - 1993	Serial Digital Interface (SDI)	See detailed notes for specific extensions.
9704 - Digital Video, Compression Conversions	SMPTE 259M - 1993	Serial Digital Interface (SDI)	See detailed notes for specific extensions.
9705 - Digital Video, Format Conversions	SMPTE 259M - 1993	Serial Digital Interface (SDI)	See detailed notes for specific extensions.
9706 - Video Image Still Frames	NITF	Video Still Specification	See detailed notes for specific extensions.
9707 - Digital Video Tape Recorder Input / Output Protocol	SMPTE 259M - 1993		See detailed notes for specific extensions.
9708 - Imbedded Time Reference	SMPTE 12M - 1995		See detailed notes for specific extensions.
9709 - Use of Closed Captioning for Core Metadata Analog Video Encoding	EIA-608 (Data Services)	Rec. Practice for Line 21	See detailed notes for specific extensions.
9710 - High Definition Television Systems (HDTV)	SMPTE 274M	High Definition Television	See detailed notes for specific extensions.
9711 - Intelligence Video Index, Geo-Spatial Metadata		Core Metadata Version 1.0, 16 Jan 97	See detailed notes for specific extensions.
Study 9712 - Intelligence Video Index, Content Description Metadata			See detailed notes for specific extensions.
Study 9713 - Advanced Video Index			See detailed notes for specific extensions.
9714 - Time Code Embedding			See detailed notes for specific extensions.
9715 - Time Reference Synchronization		Time Code synchronized to GPS	See detailed notes for specific extensions.
Study 9716 - Ancillary Data, Advanced Video Index Encoding			See detailed notes for specific extensions.
Study 9717 - Ancillary Data, Encoding into MPEG-2 Private Data Streams			See detailed notes for specific extensions.
Study 9718 - Ancillary Data, Encoding into AES3 Data Streams			See detailed notes for specific extensions.
Study 9719 - Analog Video Migration			See detailed notes for specific extensions.
9720 - Video Image Quality Specifications		VQ0 - VQ9	See detailed notes for specific extensions.
9721 - Video Tape Formats			See detailed notes for specific extensions.
9722 - Edit Decision Lists		Use of Edit Decision Lists	See detailed notes for specific extensions.
9723 - Advanced Television Systems (ATV)	ACTV Table 2.1	US Advanced Television	See detailed notes for specific extensions.

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

**9601 - Digital Video, Compression Systems**

MPEG-2 is the approved video compression format for DoD/IC systems (the VWG and ISMC formally adopted this standard in 1996).

**9701 - Digital Video, Compression Systems**

The 1996 VWG adoption of MPEG-2 (item 9601 above) as the approved video compression format is hereby superseded by a more detailed specification:

ISO/IEC 13818 - 1,2,3,4 (commonly known as MPEG-2) shall be the DoD/IC STANDARD for all compressed video, with the following PROFILE specifications:

The “MPEG-2, 4:2:2 Production Profile @ Main Level” (4:2:2 P @ ML) shall be the DoD/IC compression PROFILE for initial link origination, transmission, production, manipulation, and computer based archiving (disk based).

The “MPEG-2, 4:2:0 Main Profile @ Main Level” (MP @ ML) shall be the minimum quality DoD/IC compression PROFILE for real-time and other end-user video product distribution, including wide area transmissions.

Notes:

1) “MPEG-2, 4:2:2 P @ ML” is the preferred format for distribution where further image processing is anticipated, but “MPEG-2, 4:2:0 MP @ ML” shall be considered acceptable for wide area distribution applications such as GBS/JBS.

2) See Image Quality Assurance Recommended Practice 9720 for guidelines concerning applications constrained by low bandwidth channels and low video data rates, that may not support the use of 4:2:2 P @ ML or MPEG-2.

(VWG, 16 January 1997 - *Approved as amended* for 30 day Automatic Adoption.)

**9702 - Digital Video Waveform**

ITU-R BT601-4 Component (4:2:2) Digital Video shall be the DoD/IC STANDARD for baseband (uncompressed) video signal waveforms.

Furthermore, while both 10 bit and 8 bit implementations are allowed under the standard, 10 bit implementations are preferred, but widely implemented (significant market share) 8 bit systems will be considered as meeting the DoD/IC implementation of ITU-R BT601-4.

(VWG, 16 January 1997 - *Approved* for 30 day Automatic Adoption.)



**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

**9703 - Digital Video, Uncompressed Baseband Signal Transport and Processing**

SMPTE 259M (Serial Digital Interface), using ITU-R BT601-4 Component (4:2:2) digital video waveforms, shall be the uncompressed baseband signal transport and processing DoD/IC STANDARD for digital video, audio and metadata origination, system interface, production/analysis center processing and manipulation.

Furthermore, all DoD/IC primary routing and distribution video hardware systems must comply with SMPTE 259M Levels C and D (270/360 Mb/s) implementations. Note that 270/360 Mb/s data rates will allow routing and distribution systems to pass both 4:3 and 16:9 aspect ratio digital video signals.

Furthermore, one 259M AES3 audio channel (one stereo pair) shall be reserved for mission audio (such as narration), one 259M AES3 audio channel (one stereo pair) shall be reserved for mission metadata encoding.

Furthermore, at least 6 Mb/s of 259M ancillary data (separate from the AES3 requirements above) shall be reserved for metadata encoding.

Furthermore, 259M shall be the DoD/IC STANDARD protocol for compression system input signals and decompression system outputs when further processing is required.

Note: The "Connector Type" specification given in SMPTE 259M, Section 4, recommends a preferred connector (BNC). For DoD/IC users, such physical connections can be considered to be a Recommended Practice, not a Standard.

(VWG, 16 January 1997 - *Approved for special study group*. Comments and issues are to be submitted on 9703, 9704, 9705, and 9707. A study group of interested parties will convene to resolve issues within 30 days with Automatic Adoption following resolution.)

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

**9704 - Digital Video, Compression Conversions**

ITU-R BT601-4 shall be the transitional state, compression conversion and processing DoD/IC STANDARD for digital video, audio and metadata, where the input compressed video stream shall be uncompressed into ITU-R BT601-4 Component (4:2:2) baseband video (within 259M input/output signal processing equipment) and then shall be re-compressed into the target compression format.

Furthermore, transitional digital to analog to digital interface processing steps are specifically prohibited if all digital processing can be maintained.

Note: 1) For guidelines on use of multiple compression conversion cycles see Image Quality Assurance Recommended Practice 9720.

2) The “Connector Type” specification given in SMPTE 259M, Section 4, recommends a preferred connector (BNC). For DoD/IC users, such physical connections can be considered to be a Recommended Practice, not a Standard.

(VWG, 16 January 1997 - *Approved for special study group*. Comments and issues are to be submitted on 9703, 9704, 9705, and 9707. A study group of interested parties will convene to resolve issues within 30 days with Automatic Adoption following resolution.)

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

**9705 - Digital Video, Format Conversions**

ITU-R BT601-4 shall be the transitional state, format conversion and processing DoD/IC STANDARD for digital video, audio and metadata, where the input video format is converted into ITU-R BT601-4 Component (4:2:2) baseband video (within 259M input/output signal processing equipment) and is then re-formatted into target formats (such as 625 line component systems).

Note: 1) The “Connector Type” specification given in SMPTE 259M, Section 4, recommends a preferred connector (BNC). For DoD/IC users, such physical connections can be considered to be a Recommended Practice, not a Standard.

2) This format conversion is intended to facilitate equipment interoperability between 525/60 (American) and 625/50 (NATO) video systems, where 259M has been designed for common digital video parameters wherever practical.

(VWG, 16 January 1997 - *Approved for special study group*. Comments and issues are to be submitted on 9703, 9704, 9705, and 9707. A study group of interested parties will convene to resolve issues within 30 days with Automatic Adoption following resolution.)

**9706 - Video Image Still Frames**

The National Imagery Transmission Format (NITF 2.0 or higher) shall be the DoD/IC STANDARD for digital still images that have been extracted from video image sequences. Once an image has been captured for individual still image processing, exploitation and dissemination; the image is no longer considered to be video and is therefore not subject to this Video Working Group Standard Architecture (but must meet all NITF 2.0 or higher image standards).

Furthermore, still images should be extracted from full resolution 259M video streams, with direct conversion and storage into NITF image formats (using no transitional analog processing steps).

Furthermore, still images may be directly extracted from MPEG-2 digital files provided there are no transitional analog processing steps.

(VWG, 16 January 1997 - *Approved as amended* for 30 day Automatic Adoption.)

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

**9707 - Digital Video Tape Recorder Input / Output Protocol**

SMPTE 259M (Serial Digital Interface) shall be the DoD/IC STANDARD protocol for digital video tape input/output signals.

Furthermore, IEEE 1394 input/output protocols may be considered for digital video tape systems provided transparent IEEE 1394 to 259M translation systems are commercially available and are demonstrated compatible with 259M systems.

Furthermore, next generation “fiber channel” input/output protocols may be considered for video tape systems that are capable of HDTV recording formats.

Note: The “Connector Type” specification given in SMPTE 259M, Section 4, recommends a preferred connector (BNC). For DoD/IC users, such physical connections can be considered to be a Recommended Practice, not a Standard.

(VWG, 16 January 1997 - *Approved for special study group*. Comments and issues are to be submitted on 9703, 9704, 9705, and 9707. A study group of interested parties will convene to resolve issues within 30 days with Automatic Adoption following resolution.)

**9708 - Imbedded Time Reference**

SMPTE 12M, commonly known as SMPTE time code, shall be the DoD/IC STANDARD for time annotation and imbedded time references for video systems.

Furthermore, within 12M, Drop Frame Time Code shall be used for 29.97 FPS systems, Non-Drop Frame Time Code shall be used for 24, 25, 30, 50, 60 FPS systems.

Furthermore, the VWG will nominate for SMPTE adoption, a universal time code user bit identification value to specifically delineate a “real time acquisition” time code source from a derived (edited) time code source.

Note: The commercial standards basis for 12M has a pre-planned amendment, scheduled by SMPTE for completion in 1997, which will include a standard implementation of Year, Month, and Date encoding in the Time Code User bits. Once adopted by SMPTE, it is anticipated that this amendment will become the DoD/IC STANDARD for year, month and date metadata time code encoding.

(VWG, 16 January 1997 - *Approved as amended* for 30 day Automatic Adoption.)

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

**9709 - Use of Closed Captioning for Core Metadata Analog Video Encoding**

EIA-608 (Data Services), commonly known as closed captioning, shall be the DoD/IC STANDARD for legacy system analog video vertical interval metadata encoding using video line 21.

Note that any such analog video system data encoding is to be considered for legacy analog systems and may also be implemented by new systems for redundancy. New systems shall also conform to all applicable digital video, audio, and metadata protocols specified in this Architecture document.

Architecture item 9711 shall be the basis for geospatial metadata descriptions for DoD/IC systems using Closed Captioning (until replaced by Architecture item 9713).

Architecture item 9714 shall be the basis for time references for analog video vertical interval data. Therefore, Architecture item 9709 implementations should not be burdened with duplicate time reference data.

Furthermore, to facilitate universal inter-operability, DoD/IC users are encouraged to submit recommended implementations for analog closed captioning systems for consideration and inclusion in this Architecture document by the VWG as numbered Recommended Practices.

(VWG, 16 January 1997 - *Approved as amended* for 30 day Automatic Adoption.)

**9710 - High Definition Television Systems (HDTV)**

SMPTE 274M shall be the DoD/IC STANDARD for digital high definition video systems. Other HDTV digital standards may be adopted at future dates.

Note that SMPTE 274M is one of the allowable formats of the Advanced Television System (see item 9723).

(VWG, 16 January 1997 - *Approved* for 30 day Automatic Adoption.)

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

**9723 - Advanced Television Systems (ATV)**

The “Final Technical Report, “ by the FCC Advisory Committee on Advanced Television Service (October 31, 1995) shall be the DoD/IC STANDARD for ATV implementations.

Furthermore, the 18 scanning format constraints given in Table 2.1 of the “Final Technical Report, “ considered to be voluntary by the FCC (not adopted), are hereby considered to be a DoD/IC STANDARD for ATV implementations. Receiving systems must process all 18 formats, and transmission systems must generate at least one of the 18 formats. The general parameters of this table are repeated below:

Horizontal Pixels	Vertical Lines	Aspect Ratio	Picture Rate (I=interlace, P=progressive)				
1920	1080	16:9	—	60I	—	30P	24P
1280	720	16:9	—	—	60P	30P	24P
704	480	16:9	4:3	60I	60P	30P	24P
640	480	—	4:3	60I	60P	30P	24P

(VWG, 16 January 1997 - *Approved as amended* for 30 day Automatic Adoption.)

### **3.0 INTEROPERABILITY PROFILES AND RECOMMENDED PRACTICES FOR DOD/IC IMPLEMENTATIONS**

Where the term PROFILE is used this document assumes a documented extension to a STANDARD, promulgated by the VWG or standards organizations (such as SMPTE) in order to meet DoD/IC unique mission requirements not normally covered by commercial standards. Profiles chosen by specific VWG adoption (a VWG PROFILE, as ratified by the ISMC) should be considered as binding technical implementation policy, and as such, may be identified in Government procurement actions as a mandatory requirement in order for vendor offerings to be considered compliant for acceptance by the Government.

Where the term RECOMMENDED PRACTICE is used, this document assumes a recommended implementation or practice that further clarifies the implementation of a STANDARD in order to insure interoperability across DoD/IC systems. Recommended Practices chosen by specific VWG adoption (as ratified by the ISMC), should be considered to be a technical implementation policy, and as such, may be identified in Government procurement actions as a mandatory requirement in order for vendor offerings to be considered compliant for acceptance by the Government.

Where the term STUDY is used, this memo assumes a preliminary version of an anticipated STANDARD or PROFILE or RECOMMENDED PRACTICE where the primary initial parameters are outlined and understood but additional coordination or engineering analysis is required. Such items will be forwarded to the appropriate VWG sub-group or ad-hoc committees for action item work-off, with TBD completion suspense dates. At the time of recommendation for adoption, the STUDY will become a standard, profile, or recommended practice, using the same identification number.

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

**9711 - Intelligence Video Index, Geospatial Metadata**

The VWG Metadata Sub-Group Core Video Metadata Proposal Version 0.9, 19 December 1996, as amended by the VWG on 16 Jan 1997 (becoming baseline document Version 1.0) is the preliminary DoD/IC RECOMMENDED PRACTICE for video intelligence geospatial Metadata.

(VWG, 16 January 1997 - *Adopted.*)

Furthermore, this RECOMMENDED PRACTICE is nominated by the VWG for candidate harmonization with the SMPTE Advanced Video Index Standard (which is currently under development by SMPTE Engineering Committee PT20.05).

Furthermore, DoD/IC users may begin system development activities using this Core geospatial Metadata, with the understanding that metadata parameters may change depending on negotiations and coordination with SMPTE and commercial video equipment manufacturers. The expectation is that the geospatial metadata forms the core of the DoD/IC requirement set for the broader Advanced Video Index Standard, and once part of the broader standard, will provide significantly enhanced applicability and broad, universal inter-operability with commercial index, archive, and geospatial video systems. The SMPTE standard should provide a single standard for both DoD/IC and commercial parties.

(VWG, 16 January 1997 - *Approved for study.*)

**STUDY 9712 - Intelligence Video Index, Content Description Metadata**

An ad-hoc sub-committee of VWG or the Video Archive and Dissemination Sub-Group will prepare a STUDY (eventual Recommended Practice) for the development of video intelligence content description Metadata.

Furthermore, once this STUDY is completed, it will be nominated by the VWG for candidate harmonization with the SMPTE Advanced Video Index Standard (which is currently under development by SMPTE Engineering Committee PT20.05).

The expectation is that the intelligence content description metadata will become a defined sub-set of the broader Advanced Video Index Standard, and once part of the broader standard, will provide significantly enhanced applicability and broad, universal inter-operability with commercial index, archive, and geospatial video systems.

(VWG, 16 January 1997 - *Approved for study.*)



**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

**STUDY 9713 - Advanced Video Index**

Once elements of STUDY 9711 and STUDY 9712 have been incorporated into the SMPTE Advanced Video Index Standard (which is currently under development by SMPTE Engineering Committee PT20.05), and have been evaluated as meeting DoD/IC requirements, the SMPTE Advanced Video Index will become the DoD/IC STANDARD for video system metadata and will replace any systems incorporating RECOMMENDED PRACTICES 9711 and 9712.

(VWG, 16 January 1997 - *Approved for study.*)

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

**STUDY 9714 - Time Code Embedding**

Digital Vertical Interval Time Code (D-VITC) shall be imbedded on digital video line 9 of all ITU-R BT601-4 Component (4:2:2) and 259M systems. Users may implement Longitudinal Time Code (LTC) for internal processing (such as in tape recorders) provided D-VITC is always forwarded to the next processing element on digital video line 9.

Furthermore, SMPTE Ancillary Time Code (embedded in the 259M Ancillary data space) may be used instead of D-VITC, provided such time code data is readily readable as part of the delivered ancillary data stream.

Furthermore, legacy DoD/IC analog video systems that require Time Code shall imbed Time Code on analog vertical interval video line 19. Users may implement Longitudinal Time Code (LTC) for internal processing (such as in tape recorders) provided analog video line 19 VITC is always forwarded to the next processing element.

*(Awaiting VWG Action)*

**9715 - Time Reference Synchronization**

Global Positioning System, universal coordinated time, clock signals shall be used as the universal time reference for DoD/IC SMPTE 12M time code systems, allowing systems using time code to accurately depict the actual Zulu time of day of video acquisition / collection / operations.

Furthermore, when DoD/IC “original video acquisition” video sequences are used as sources for editing onto new “edit master” sequences, the “edit master” sequence may have a new, linearly contiguous time code track. The time code for the new sequence should reflect the “document date” of the new video product.

*(Awaiting VWG Action)*

**STUDY 9716 - Ancillary Data, Advanced Video Index Encoding**

Once elements of STUDY 9713 (the SMPTE Advanced Video Index Standard) have been adopted, a new “259M Ancillary Data Encoding Standard” (which is currently under development by a SMPTE Engineering Committee) will be created to define how STUDY 9713 can be encoded into the 259M Ancillary format.

Furthermore, once SMPTE adopts this standard and it has been evaluated as meeting DoD/IC requirements, the SMPTE Ancillary Data, Advanced Video Index Encoding Standard will become a DoD/IC STANDARD for all video systems.

*(Awaiting VWG Action)*

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

**STUDY 9717 - Ancillary Data, Encoding into MPEG-2 Private Data Streams**

Once elements of STUDY 9716 have been adopted, a new “Ancillary Data Encoding into MPEG-2 Private Data Streams Standard” (which will be shortly proposed for development by a SMPTE Engineering Committee) will be created to define

how STUDY 9716 Ancillary Data will be encoded into MPEG-2 Private Data Streams.

Furthermore, once SMPTE adopts this standard and it has been evaluated as meeting DoD/IC requirements, the SMPTE Ancillary Data Encoding into MPEG-2 Private Data Streams Standard will become a DoD/IC STANDARD for all video systems.

*(Awaiting VWG Action)*

**STUDY 9718 - Ancillary Data, Encoding into AES3 Data Streams**

Once elements of STUDY 9716 have been adopted, a new “Ancillary Data Encoding into AES3 Data Streams Standard” (which will be shortly proposed for development by a SMPTE Engineering Committee) will be created to define how STUDY 9716 Ancillary Data will be encoded into AES3 Data Streams.

Furthermore, once SMPTE adopts this standard and it has been evaluated as meeting DoD/IC requirements, the SMPTE Ancillary Data Encoding into AES3 Data Streams Standard will become a DoD/IC STANDARD for all video systems.

Furthermore, given that there is an existing SMPTE Standard for AES3 attachment to MPEG-2 Private Data Streams, it is anticipated that formatting metadata into AES3 will thereby allow use of an existing SMPTE standard to handle AES3 MPEG-2 Private Data Stream data encoding.

*(Awaiting VWG Action)*

**STUDY 9722 - Edit Decision Lists**

When DoD/IC “original video acquisition” video sequences are used as sources for editing into new “edit master” sequences, the “edit master” sequence should use Edit Decision Lists (EDL) to specifically identify the source video sequences.

Furthermore, originators of new edit master sequences shall archive such EDLs in order to specifically locate the source video sequences (and their original metadata).

*(Awaiting VWG Action)*

## **4.0 IMAGE QUALITY ASSURANCE RECOMMENDED PRACTICES**

### **STUDY 9719 - Analog Video Migration**

All DoD/IC video production systems that currently use ANSI/SMPTE 170M analog video waveforms (also known as RS-170A) should convert to ITU-R BT601-4 Component (4:2:2) digital waveforms as soon as practical.

Furthermore, all new digital baseband video system production waveforms shall conform to ITU-R BT601-4 Component (4:2:2) waveforms.

Furthermore, unique mission systems with legacy analog video waveforms should convert such analog video waveforms to ITU-R BT601-4 Component (4:2:2) waveforms as soon as possible in the signal processing chain, with no processing node backwards conversions to analog waveforms allowed.

*(Awaiting VWG Action)*

*This study will require further research as to how to integrate known legacy analog systems (such as analog UAV, handheld, Sub, Air, etc.).*

### **STUDY 9720 - Video Image Quality Specifications**

A “Video Quality Matrix” table shall define Video Image Quality specifications as a common shorthand reference for all DoD/IC video systems to facilitate descriptions of quality and mission satisfaction criteria.

Furthermore, the quality specifications (VQ9 - VQ0, where VQ9 is the highest quality) should only be applied to any single processing node of the end-to-end video chain, with the overall system quality specification equaling, at best case, the poorest video quality processing node specification. DoD/IC oversight organizations will need to determine methodologies to rate the end-to-end video chain quality specification and may use the same VQ scale to describe overall system performance. The “Video Quality Matrix” includes tables of “Technical Specifications,” tables of “Intelligence Requirements and Satisfaction Measures”, and related tables of “Technical Notes.”

*(VWG, 16 January 1997 - Agreed that quality scale should run from VQ9 - VQ0, with VQ9 representing the highest quality.)*

*(VWG, 16 January 1997 - Approved for study.)*

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

**Video Quality Matrix, Table of Technical Specifications**

Quality Level	Applicable Standard	Nominal Horizontal Resolution	Nominal Vertical Resolution	Nominal Bit Depth	Frame Rate	Maximum Compression Ratio	Video Data Rate/Range	Nominal Channel Data Rate	Channel Data Rate Range	Known Transport Channel
<b>VQ9</b>	274M	ATSC	ATSC	ATSC	ATSC	ATSC	ATSC	ATSC	ATSC	ATSC
<b>VQ8</b>	259M (4:2:2) 4:3*, 16:9 Aspect Ratios	720* /	486* /	10	30 FPS	Zero	166*-2xx Mb/s	270*-360 Mb/s	270*-360 Mb/s	
<b>VQ7</b>	259M (4:2:2)	720	486	8 or 10	30 FPS	Zero to 2:1	1xx-166 Mb/s	270 Mb/s	166-270 Mb/s	259M Wire, ATM @ 155Mb/s, NRT DS3 @ 45Mb/s, NRT E3 @ 34Mb/s,
<b>VQ6</b>	MPEG-2 4:2:2 P @ ML	704	480	8	30 FPS	5:1	55 Mb/s	55 Mb/s	22-55 Mb/s	Any VQ7
<b>VQ5</b>	MPEG-2 4:2:2 P @ ML	704	480	8	30 FPS	10:1	20 Mb/s	20 Mb/s	11-21 Mb/s	Any VQ6
<b>VQ4</b>	MPEG-2 4:2:0 MP @ ML	540	480	8	30 FPS	20:1	6 Mb/s	6 Mb/s	4-10 Mb/s	GBS
<b>VQ3</b>	MPEG-1	360	240	8	30 FPS	As Required	1.5 Mb/s	1.5 Mb/s	1.5-4 Mb/s	T1
<b>VQ2</b>	Non-Standard MPEG-2 VWG Profile	704	480	8	8 FPS	As Required	1.5 Mb/s	1.5 Mb/s	As Required	T1
<b>VQ1</b>	Non-Standard MPEG-2 VWG Profile	704	480	8	1 FPS	As Required	As Required	As Required	As Required	ISDN
<b>VQ0</b>	NITF	720	486	10	Still Image	As Required	As Required	As Required	As Required	Non-Real Time (NRT)

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

**Video Quality Matrix, Table of Intelligence Satisfaction Measures**

Quality Level	Video NIIRS Rating	Delta NIIRS (for specified Altitude)	Delta NIIRS (for specified Focal Length)	EEl Specification (Detect Activity)	EEl Specification (Determine/Report Status)	EEl Specification (Track Vehicles/Ships)	EEl Specification (Count and Identify Equipment)	EEl Specification (Report Movement)	
VQ9									
VQ8									
VQ7									
VQ6									
VQ5									
VQ4									
VQ3									
VQ2									
VQ1									
VQ0									

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

**Video Quality Matrix, Table of Technical Notes**

- VQ9 High resolution, Digital high definition television systems (HDTV). VQ9 includes by specific reference the SMPTE 274M HDTV format. Other HDTV digital standards may be incorporated into VQ9 at future dates.
- VQ8 Digital 4:2:2 baseband uncompressed video. Note that while both 10 bit and 8 bit implementations are allowed under VQ8, 10 bit implementations are preferred, but widely implemented (significant market share) 8 bit systems will be considered as meeting VQ8. Note that storage systems (such as some digital video tape formats) that use 259M 4:2:2 input/output protocols but use 2:1 internal compression DO NOT meet VQ8. Furthermore, all primary routing and distribution hardware systems must comply with the SMPTE 259M Level C and D (270/360 Mb/s) implementations to meet VQ8.
- VQ7 Digital 4:2:2 baseband video with no more than 2:1 compression. Note that while both 10 bit and 8 bit implementations are allowed under VQ7, 10 bit implementations are preferred, but widely implemented (significant market share) 8 bit systems will be considered as meeting VQ7. Also, widely implemented (significant market share) storage systems (such as digital video tape) that use no more than 2:1 compression and use 259M 4:2:2 input/output protocols will be considered as meeting VQ7.
- VQ6 Digital 4:2:2, MPEG-2 compressed video, with no more than 5:1 compression. Note that 5:1 compression ratio compliant MPEG-2, 4:2:2 Production Profile @ Main Level based systems are anticipated to meet VQ6 quality specifications.
- VQ5 Digital 4:2:2, MPEG-2 compressed video, with no more than 10:1 compression. Note that 10:1 compression ratio compliant MPEG-2 4:2:2, Production Profile @ Main Level based systems are anticipated to meet VQ5 quality specifications.
- VQ4 Digital 4:2:2, MPEG-2 compressed video, with no more than 20:1 compression. The input resolution may be de-rated from nominal ITU-R BT601-4 Component (4:2:2) resolution in order to meet target data compression rates, until the resolution approaches SIF resolution, at which point the quality shall be considered to be at VQ3.

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

**Video Quality Matrix, Table of Technical Notes (Cont.)**

- VQ3 Digital MPEG-1 compressed video, using SIF image resolution decimation, 30FPS temporal rate.
- VQ2 Digital compressed video (non-standard, but having the general attributes of MPEG-2, 4:2:0), using full ITU-R BT601-4 Component (4:2:2) image resolution but using de-rated temporal resolution (on the order of 8 FPS) to meet limited bandwidth data distribution channels. Note that such temporal decimation is not part of the MPEG-2 standard and will therefore require further research to determine actual user implementations.
- VQ1 Digital compressed video (non-standard, but having the general attributes of MPEG-2 4:2:0), using a combination of image resolution decimation and temporal (frame rate) decimation (on the order of 1 FPS). VQ1 is intended as a “end-user distribution format of last resort,” where severe bandwidth limitations preclude full motion video distribution. Note that such temporal decimation is not part of the MPEG-2 or MPEG-1 standards and will therefore require further research to determine actual user implementations. Furthermore, very low data rate, proprietary “Internet video” signal formats (such as AVI and Quicktime) that are not MPEG-1 or MPEG-2 compliant are specifically defined as only meeting VQ1 quality specifications.
- VQ0 The quality specification for still images derived from video shall conform to NITF standards (see PROFILE 9706 - Video Image Still Frames).



**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

**STUDY 9721 - Video Tape Formats**

The Image Quality Assurance Practices for DoD/IC video tape formats shall be:

**Video Quality 9**

There are no specific recommendations for Video Quality 9 (see Video Quality Matrix for additional information) video tape implementations at this time. However, any digital tape format converted into a “bit-bucket” mode with sufficient data bandwidth to store uncompressed or compressed HDTV signals may be used for HDTV Video Quality 9 implementations.

**Video Quality 8**

For Video Quality 8 implementations (See Video Quality Matrix for additional information), authorized video tape formats may include widely accepted commercial systems that:

- a) Use 4:2:2 digital processing,
- b) Have no compression,
- c) Use 259M (SDI) input/output protocols,
- d) Transparently transports a minimum of two stereo AES3 audio channels,
- e) Transparently transports Digital Vertical Interval Time Code (LTC internal processing/storage is authorized provided DVITC input and output is maintained),
- f) Transparently transports a minimum of an additional 6 Mb/s of Ancillary data (either as part of the 259M Ancillary data stream or as additional AES3 audio streams).

Anticipated VQ8 compliant (subject to verification) tape formats may include :

SMPTE D1 video tape format  
SMPTE D5 video tape format

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

Video Quality 7

For Video Quality 7 implementations (See “Video Quality Matrix” for additional information), authorized video tape formats may include widely accepted commercial systems that:

- a) Use 4:2:2 digital processing,
- b) Have no more than 2:1 compression,
- c) Use 259M (SDI) input/output protocols,
- d) Transparently transports a minimum of two stereo AES3 audio channels,
- e) Transparently transports Digital Vertical Interval Time Code (LTC internal processing/storage is authorized provided DVITC input and output is maintained),
- f) Transparently transport a minimum of an additional 6 Mb/s of Ancillary data (either as part of the 259M Ancillary data stream or as additional AES3 audio streams).

Anticipated VQ7 compliant (subject to verification) tape formats may include :

Any VQ8 video tape format  
Ampex DCT video tape format  
Sony Digital Betacam tape format

Video Quality 6

For Video Quality 6 implementations (See “Video Quality Matrix” for more information), authorized video tape formats may include widely accepted commercial systems that:

- a) Use 4:2:2 digital processing,
- b) Have no more than 5:1 compression,
- c) Use 259M (SDI) input/output protocols,
- d) Transparently transports a minimum of two stereo AES3 audio channels,
- e) Transparently transports Digital Vertical Interval Time Code (LTC internal processing is authorized provided DVITC input and output is maintained),
- f) Transparently transports of a minimum of an additional 3 Mb/s of Ancillary data (either as part of the 259M data stream or as additional AES3 audio streams).

Anticipated VQ6 compliant (subject to verification) tape formats may include :

Any VQ8, VQ7 video tape format  
JVC Digital-S video tape format  
Sony Beta-SX video tape format  
DVC Pro (4:2:2) video tape format

**VIDEO WORKING GROUP STANDARDS ARCHITECTURE**  
**VERSION 0.96 16 January 1997**

Video Quality 5 through Video Quality 1

For all other Video Quality implementations (VQ5-1), it is anticipated that computer based storage systems will be used instead of video tape. If video tape is used, digital video tape formats other than VQ8, VQ7, VQ6 may only be used in order to meet specific mission constraints (size, weight, power consumption) that can not be met with VQ8, VQ7, VQ6 tape formats. In such instances, other such formats may only be used in limited roles such as first generation acquisition, with a requirement to immediately transfer and interface such acquisition formats to SMPTE 259M (with VQ8, VQ7, VQ6 tape systems) at the first processing interface.

Anticipated “acquisition-only” tape formats, in order of priority of choice are:

- a) Any VQ8, VQ7, VQ6 video tape format
- b) 4:1:1 Digital tape formats
- c) Component Analog formats (Y,R-Y,B-Y), such as Betacam-SP or MII
- d) High Resolution Analog formats (Y/C), such as Hi8mm or SVHS

“Analog - composite - limited resolution - color under” video tape formats (such as VHS or U-Matic) are not authorized for acquisition, processing or new archive implementations. “Analog - composite - limited resolution - color under” video tape formats may be authorized as the means for video tape mass distribution of finished intelligence products, provided no other digital distribution tape format is widely available. In no case are such formats authorized for new permanent video archive storage. Existing, legacy archive systems based on “analog - composite - limited resolution - color under” tape formats should convert to one of the new, approved digital tape formats as soon as practical.

Digital composite formats (such as D2, D3) are generally not authorized for any new DoD/IC implementations because of their incompatibility with 4:2:2 component processing systems.

No video tape formats other than VQ8, VQ7, or VQ6 compliant systems may be used for any new permanent video tape archives.

The elements of Standards Architecture Section 5.0 have been moved to Section 1.0